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SUDDEN ACUTE ABDOMINAL PAIN: ITS SIGNIFICANCE.

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ABDOMINAL surgery is no longer a pioneer work. It is the result of the accumulated experience of the past fifty years. Its success is based on well-tried processes. It is a jealous field, filled with battles lost and won, dotted here and there with sad regrets, chagrin from unavoidable mistakes, but often brightened by the light of success. A master-hand in abdominal surgery is a hard-earned reputation. However, the accumulative experience of fifty years has still left obscure points in abdominal surgery which the genius of Lawson Tait attempted to set at rest by the exploratory and confirmatory incision.

During the past ten years I have been particularly interested in gynecology and abdominal surgery, and all along these years has risen the question of abdominal pain and its signification. To interpret abdominal pain requires the best skill of the finest heads.

Location.—How far can we diagnose abdominal pain by its locality? Only to a limited degree. Associated circumstances must aid in the diagnosis. There are three common localities of acute abdominal pain, or peritonitis,—viz., pelvic, ceco-appendicular and that of the gall-bladder region, and as probability is the rule of life, it is well to diagnose acute abdominal pain as a disturbance in one of these three localities of the peritoneum.

Acute abdominal pain in general is referred to the navel,—in other words, to the region immediately over the solar plexus or abdominal

brain. Acute abdominal pain is due to a disturbance of the peritoneum, owing to a lesion of an adjacent viscus; but since the peritoneal pain can arise from many organs and from several points of the same organ, it demands the most experienced diagnostic acumen and the most mature judgment to interpret the significance of the trouble. No one can decide what kind of wood lies under a table-cloth. I have repeatedly observed in appendicitis that patients say the acute pain, especially in the beginning, is over the whole middle of the abdomen (solar plexus). This may be due to excessive and violent peristalsis of the small intestines. As regards locating the pain at any point of the small intestines, it cannot be done, first, because the loops of intestine have no distinct order as to locality; second, the patient cannot discriminate a point of pain at any given point,—perhaps from lack of practical experience. With few exceptions to locate the seat of trouble in acute abdominal pain, we call to our aid the pain elicited by pressure. Pressing the abdominal walls produces a distinct localized tenderness or pain which suggests localized pathology. Again, rigidity or tension of the abdominal wall is suggestive of a pathologic locality. This symptom is purely reflex, due to irritation passing from the involved viscera to the spinal cord, whence its irritation is transmitted to the periphery of the lower intercostal nerves which control the abdominal muscles over the seat of pain. Dashing cold water on the belly will produce similar protective muscular rigidity. Hence, in general, the location of disease in the abdomen from the patient's feeling of sudden acute pain is quite indefinite. But local tenderness and local pain on pressure aid very much. Localized rigidity of the abdominal wall is suggestive that such tension is protecting the seat of disease from motion, further bacterial or fecal invasion. In short, the rigid muscles are putting the pathologic parts to rest.

Vomiting is a general characteristic of sudden acute abdominal pain. In sudden acute abdominal pain, from visceral lesion, Nature makes profound effort to manifest its distress, but to diagnose the seat of pathology and nature from the localization of the pain requires much reading between the lines from experience and judgment.

Again, a vast difference arises between sudden acute abdominal pain and the abdominal pain which comes on slowly. Much depends on the stage of the disease in which the physician first visits the patient.

The signification of sudden acute abdominal pain may be realized better by a short consideration of some of the principal conditions which occasion it.

The first class of sudden acute abdominal pain chiefly arises from the digestive tract. The second class arises from the genito-urinary.

(1) In the category of the digestive tract, producing sudden acute abdominal pain, we place *interstitial obstruction* from (a) strangulation by bands and through apertures; (b) invagination; (c) volvulus, and (d) perforation. The mode of onset in all of these is sudden and violent and nearly always accompanied by vomiting.

Strangulation by bands and through apertures constitutes one-third of all interstitial obstructions. If the bowel loops slip through an inguinal or femoral aperture, digital examination will detect the cause of the sudden, acute abdominal pain. Obturator and sacro-sciatic hernia are seldom diagnosed, so that practically they would come under internal strangulation by peritoneal bands. Sex does not aid in diagnosis, for males and females about even up in peritonitis during life, and hence will possess about the same amount of peritonitic bands to strangle bowel loops.

A history of previous peritonitis tells the story of strangulation by bands. Vomiting is violent, pain from peristalsis is periodic and general over the abdomen. The pain is not due to stoppage of the fecal current, but to reflex irritation of the bowel at the seat of obstruction. Temperature is not conspicuous and the pulse is not much changed. Tympanitis arises in exact proportion to the peristalsis of the bowel wall above the seat of obstruction. At first the pain is violent, but it subsides with the progress of the case, becoming more continuous and generally diffused. If the patient be quiet, the pain is so slight that it deceives the most elect. No stool, no gas per rectum, no detectable swelling at any hernial aperture with continuous abdominal pain and vomiting demand surgical notice. The temperature and pulse are not reliable. Strangulation by bands will generally give no tender location on pressure and no detectable swelling, and, in fact, I have watched cases with the abdomen quite soft and pliable with no possible physical point of diagnostic value, not even tympanitis. In one case the pain was at first severe, general, and almost subsided the day before the operation, yet fifteen feet of gut was as red as a sunset. The sudden, acute abdominal pain is not due to the constricting band, but to reflex irritation transmitted to the abdominal brain where reorganization occurs, whence it is emitted to the whole digestive tract, inducing violent, disordered, and wild peristalsis (colic).

Acute, sudden, abdominal pain, due to a constricting peritoneal band is one of the most obscure matters to interpret. To explore the abdomen in the proper time for such cause requires a wise diagnostician and a bold surgeon. The matters to bear in mind in stran-

gulation by bands are the acute, sudden abdominal pain with a violent onset, vomiting, and the distinct colicky, peristaltic, periodic character of the suffering, not forgetting a previous history of peritonitis. However, the sudden, acute abdominal pain arising from strangulation of a loop of bowel by peritonic bands is difficult to interpret and seldom diagnosed. It may be asserted that when a patient is suffering from some grave disease, manifest only by sudden acute abdominal pain, the nature of which cannot be interpreted, an early exploratory laparotomy is justifiable and demanded. Such obscure cases require an experienced and skilled surgeon in abdominal work to meet any emergency. I remember very distinctly the case of a man about forty who gave consent to my colleague, a general practitioner, who was entirely untrained by experience or observation in abdominal surgery. The doctor told me he opened the abdomen and found a band stretching tightly across the ascending colon. But he said "the colon was black, and I did not know what to do with it, so I closed the abdomen." It is needless to say that the man made a prompt, fatal exit. But most cases die undiagnosed. The danger of strangulation by bands is gangrene and perforation.

Invagination constitutes about one-third of all interstitial obstructions, and the sudden acute abdominal pain arising from this cause is more easily interpreted. Age signifies much in this case, for one-fourth of all invagination occurs before the end of the first year of life, and one-half before the end of ten years. Invagination is a disease of childhood. Its mode of onset is sudden and often violent. From some twenty-five experiments in invaginating the bowel of the dog, I am sure the pain is periodic at first. The griping, colicky, peristalsis is rhythmic, depending on irritation. At stated times the dog suddenly spreads wide his four feet and arches his back, appearing in severe distress, then gradually recovers his natural attitude. In invagination blood occurs in the stool in 80 per cent. of cases (especially children), and the vomiting is not violent nor even always conspicuous, for the bowel is only partially occluded. Seventy per cent. of invagination occurs at the ileo-cecal apparatus,—that landmark in man's clinical history,—15 per cent. in the small intestines, and 15 per cent. in the large bowel. Invagination manifests abdominal pain similar to a long enterolith in the bowel which in turning leaves small spaces at its side for the passage of gas and some liquid stool. I have, unfortunately, watched a case of enterolith day after day, not being able to interpret the abdominal pain or to diagnose the case until gangrene of the bowel occurred at the seat of the enterolith, when nature asserted sufficient manifestation to explore the abdomen, but with a fatal result. The most skilled of abdominal sur-

geons repeatedly examined this case, but could not interpret the acute abdominal pain which came on suddenly, though as the days glided on it quietly subsided. The patient was a physician, but could not localize any abdominal pain; it was diffuse. Temperature was about $99\frac{1}{2}^{\circ}$ and 100° F., and the pulse was 85 to 95 almost the whole week of illness. The abdomen was generally soft and not tympanitic. Very seldom can an abdominal tumor be felt in the bowel invagination. Shock in young children is quite conspicuous, yet I personally know of two autopsies in infants who were attended in life by three of the most skilled by Chicago abdominal surgeons, yet in neither case was the diagnosis of invagination made, which the post-mortems revealed as the cause of death. A skilled and experienced physician, such as was the late Dr. Jaggard, took an eight months' infant and stripped off the clothing to be more thorough in examination, and yet, after all his diagnostic skill, failed to locate disease in the bowels. The child was very pale, cried a little, and died thirty hours after the attack. The autopsy revealed ileo-cecal invagination.

Sudden, acute abdominal pain in a child may with high probability be interpreted as invagination, especially if one can detect the periodic, peristaltic character, its colicky nature. Blood following in the stool is almost pathognomonic. A tumor will rarely be found, and pressure on it will not generally elicit tenderness. It is not at all likely that the patient can locate the seat of the disease from the pain. Tympanitis and vomiting are not conspicuous, and the temperature and pulse are unreliable. The danger of invagination is sloughing of the apex or neck and consequent perforation. Invagination presenting at the anus interprets easily the cause of the pain. Volvulus is so rare that it constitutes about one-fortieth of all interstitial obstructions, and occurs about four times as often in men as women. As in invagination so in volvulus, I was always compelled to suture them in position in a dog. But I never succeeded in establishing a permanent volvulus in the dog. Volvulus is characterized by tympanitis, and it is said by severe periodic pain. Volvulus occurs at the sigmoid in 60 per cent. of the cases; at the ileo-cecal valve in 30 per cent., and in the small intestines in 10 per cent. I have seen partial, but never complete, volvulus in man. Senn operated successfully on a man, on the eighth day, for sigmoid volvulus. The man had enormous tympanitis; his pain is not described as severe, but no doubt the suffering is severe.

At first the pain is periodic, but as time advances it becomes more constant, with now and then exacerbations. Vomiting, though not conspicuous, must arise more or less from trauma to the peritoneum. Perhaps the sudden pain, chronic constipation, and rapid

rise of tympanitis would aid in interpreting volvulus, but seldom can one diagnose such a disease, pain no doubt would be referred to the abdominal brain. Most clinicians note tympanitis as a conspicuous feature of volvulus.

In perforation it is very difficult to interpret the sudden abdominal pain. Associated circumstances would aid. In typhoid fever one would naturally suspect perforation if sudden acute abdominal pain arose, and my colleague, Dr. Van Hook, successfully operated on a typhoid perforation diagnosed by his medical friend. One might think if he was called to a young woman with sudden acute abdominal pain that it was a round, perforating ulcer of the stomach, after excluding pelvic and appendicular disease. But the sudden acute abdominal pain of perforation is so vague and indefinite that only an exploratory incision would interpret it.

The sudden acute abdominal pain from appendicitis (perforation) is more apt to be diagnosed. Now probability is the rule of life, and when one is called to a boy or man up to 35 with sudden acute abdominal pain, it is likely appendicitis. The pain of appendicitis is at first sudden and generally diffuse, and the sudden pain in appendicitis is, in my experience, a characteristic and conspicuous feature of it. The sudden acute pain in appendicitis is doubtless due to violent appendicular peristalsis (colic) or the rupture allowing the bowel contents to come in contact with the peritoneum, and also inducing violent irregular peristalsis of the adjacent bowel loops. Rigidity of the abdominal muscles over the seat of pathology in appendicitis is a great aid to interpreting the pain. The muscular rigidity is protective and due to the transmission of the visceral irritation to the spinal cord which is reflected to the abdominal muscles. There is a nice balance between the peripheral visceral nerves and the peripheral nerves in the abdominal muscles. Local tenderness and local rigidity of the abdominal muscles is a great aid in signification of the sudden acute pain in appendicitis. It might be well to suggest that the position of the appendix is extremely variable. In 350 autopsies I noted the appendix located all the way from the under surface of the liver to the floor of the pelvis, and also many times where there was more or less of a mesenterium commune, the cecum turned towards the vertebral column, and the appendix is then liable to lie among the small intestines,—the dangerous ground of peritonitis. It is likely that the pain in appendicitis depends on the seat of the disease,—*i.e.*, the mucous membrane has become ulcerated, inducing appendicular colic (peristalsis), while the sudden exacerbation of violent diffuse abdominal pain is due to the involving of the peritoneum itself. I see nothing especially worthy of attention in

the so-called McBurney point. Pain over the seat of pathology is certainly a natural feature, and generally the appendix lies under a point midway between the umbilicus and anterior superior spine of the ileum. But it is not always so by any means, for I examined with great and anxious care, a short time ago, a young physician with severe pain over the so-called McBurney point, when on operation the long appendix was down in the pelvis and perforated. It is a fair proposition to say that tenderness and pain on pressure is approximately over the seat of disease, so to speak of a so-called McBurney point is redundancy. Then, again, pain on pressure may be reflex, bobbing up in remote regions of the abdomen. The sudden, acute, diffuse abdominal pain arising in appendicitis generally subsides to the right iliac fossa after thirty-six hours, and one can nearly always elicit pain on pressure. This pain on pressure is doubtless the motion transmitted to a sensitive, inflamed peritoneum, and not the dragging on an adhesion, as some assert, for adhesions so newly formed can have no nerves formed in them. But man is subject to appendicitis four times as frequently as woman, due, perhaps, to Gerlach's valve being small in man, and thus not allowing the foreign body to escape after entrance, or due to the greater activity of the psoas muscle in man. The appendix lies on the psoas muscle in man more frequently than in woman, and on its longest range of activity, hence when the appendix contains virulent and pathogenic germs the long range of action of the psoas so traumatizes the appendix that it induces the escape or migration of the accidental virulent pathogenic microbes through the appendicular walls into the peritoneal wall or cavity. Common sense and experience would dictate that the pain on pressure would occur in any point of the abdomen possessing inflamed structures. Since probability is the rule of life, it is well to look to the three great regions of dangerous peritonitis,—viz., pelvic, appendicular, and gall-bladder region.

The digestive tract has still another common seat for sudden acute abdominal pain, and that is the gall-bladder region. The sudden acute abdominal pain in hepatic colic is not generally so violent as many others accompanying acute diseases of the digestive tract. Patients relate that the pain is aching, dragging, and in the active stage cutting or tearing. Some relate a feeling of tightness or fulness. But it depends on whether the stone is attempting to enter the mouth of the duct or whether it has already entered. I have had typical cases where operation proved that the stones only attempted to enter the duct. No doubt these are the cases which say so often that they have some severe pains at any time, but espe-

cially after taking hot meals, hot or stimulating drinks, whence arises excessive peristalsis inducing short, temporary hepatic colic. Now, when the gall-bladder has many small stones in it, and when one more or less often attempts to engage in the neck of the gall-bladder, the pain is rhythmical. It begins slowly and rises to a maximum. At the maximum the pain is intense. We have observed such cases and afterwards operated on them, removing many small stones. Gall-stones are perhaps four times as frequent in women as in men; why, we do not know. In my experience patients can generally localize the pain in gall-stones more accurately and definitely than almost any other sudden acute abdominal pain. They refer the pain to its proper locality: however, I must admit that this reference is before rupture. After rupture of bladder or duct the pain is indefinite, like other perforations. The sudden acute abdominal pain in gall-troubles is characterized by more slowness, less acute intensity, distinct periodicity than invagination, appendicitis, or perforation of the digestive tract. Jaundice is not necessary. Jaundice depends on the color of the eyeball, and not the skin. A feature in gall-bladder pain is that it extends well towards the dorsum. Age aids in diagnosing stone in the biliary passages to some extent.

In renal (genito-urinary) colic it must be said that the pain resembles that of the hepatic colic in many ways, in rhythm being paroxysmal. It intermits and is often agonizingly spasmodic. It requires much careful study to differentiate the sudden acute abdominal pain in hepatic and renal colic from each other. This is important, for the plan of action is very different. The pain in appendicitis, renal, and hepatic colic are in close relation.

The sudden acute abdominal pain arising from the genitals (genito urinary) is more easily interpreted and managed. The pain can be more definitely located by the patient and sudden disorganization of viscera, being accessible in the pelvis is much more within control of the gynecologist. The sudden acute abdominal pain from the genitals is generally a ruptured ectopic pregnancy or the very rare matter of the rupture of a pyosalpinx into the peritoneal cavity. Most other pelvic pains are of slower origin and almost always diagnosable. Sex and the reproductive age aid in the interpretation of the case.

Remember the three dangerous peritonitic regions,—viz., pelvic, appendicular, and gall-bladder.

In regard to the character of sudden acute abdominal pain, it varies as to (a) its mode of attack, and (b) as to the viscera attacked.

If one will closely watch the sudden acute abdominal pain, it will be quite apparent that the character of the pain in most of the

acute affections of the abdomen is very similar. We only observe in reality a difference in degree of pain from the bearable to the agonizing. In perforation the character of the pain is the same in all viscera. In invagination it is paroxysmal and periodic, at least at first, due to irregular and violent peristalsis in internal strangulation; it is generally intense and periodic, due to violent peristalsis, later continuous and of an aching, dragging character, due to paralysis of bowel segments. In appendicitis the pain is nearly always sudden and intense,—*i.e.*, the perforative variety. The variety of appendicitis with slowly increasing pain is likely lymphatic in invasion and not dangerous, simply medical, of course the appendicular mucosa may be perforated. Sudden, acute abdominal pain of a lancinating character, and being quite continuous is very liable to be perforation of the appendix or digestive tube, and the continuous, agonizing character of the pain is a heraldic symptom of diffuse peritonitis, the knell of life. It may be remembered that the character of the sudden acute abdominal pain will depend on the capacity of any viscus for peristalsis,—*i.e.*, its capacity to cause colic by violent, wild, irregular muscular action. In peristalsis periodicity must not be lost sight of, and the etiology which gives rise to the irritation, inducing the peristalsis. It may be transitory in character, as food irritation, rapidly forming and reducing invagination or a stone attempting to enter a duct. Or the pain may be continuously periodic, as a stone lodged in some canal, appendix, ureter, small intestine, or biliary ducts.

In regard to the location of sudden acute abdominal pain we have to consider (*a*) the seat of pain as felt by the patient; (*b*) the pain elicited by pressure (tenderness); (*c*) local rigidity of the abdominal muscles; and (*d*) anesthetic or hyperesthetic condition of the skin of the abdomen.

In general, sudden acute abdominal pain is referred by the patient to the umbilical region, to the solar plexus, directly over the abdominal brain. This, in my opinion, is a nervous centre, possessing the power of reorganization, receiving and transmitting forces of controlling visceral circulation and of inducing reflex or referred pain. The irritation of peripheral visceral nerves is transmitted to the abdominal brain, whence reorganization may make the pain felt over the abdominal brain, at the seat of pathology or a remote abdominal point due to a very supersensitive nervous system.

As to local tenderness or pain elicited by pressure, it indicates a pathologic condition of the peritoneum (inflammatory). The pain is induced by motion or disturbance communicated to a sensitive inflamed peritoneum.

Local rigidity of abdominal muscles indicates adjacent underlying pathology of organs supplied by the same nerves as the muscles which exercise a protective agency to preserve rest for damaged tissue to assume repair and prevent further destruction from motion. Hyperesthesia or sensitiveness of the skin, due to transmitted irritation, is often present, but is not very reliable as to locality, for it is dependent on peculiar symptoms, and accompanies, more or less, though irregularly, most acute abdominal affections. Of course, it would be expected that the severe sudden acute pain in the kidney and gall-ducts, being very near to the abdominal brain, would be difficult to separate from the solar plexus. Lead colic may deceive the most elect as to its etiology or seat.